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Dr. D. G. Brinton was elected a member.

On favorable report of the Committee, the paper of Dr. Leidy, presented Sept. 15th, entitled "Extinct Mammalia of Dakota and Nebraska," etc., reported in favor of its publication in the Journal.

On favorable report of the Committees, the following papers were ordered to be printed:

Notice of American Species of PTYCHODUS.

BY JOSEPH LEIDY, M. D.

The Cestracient genus of fishes *Ptychodus*, so far as known, is confined to the Cretaceous Formations. Remains, consisting of teeth, I have had the opportunity of inspecting from Alabama, Mississippi and Kansas, and although reported to exist in the Cretaceous Formation of Delaware, I have not met with them from that locality nor from the Green Sand, of corresponding age, of New Jersey. The following list comprises all the specimens of American *Ptychodus* teeth I have had the opportunity of examining.

PTYCHODUS MORTONI.

Agassiz, Poissons Fossiles III. (1833-43), 158, Tab. 25, figs. 1-3; copied in figs. 773, 773a, of Dana's Manual of Geology.

Palate bone of a fish? Morton: Syn. Org. Rem. Cret. Group. (1834), pl. xviii, figs. 1, 2.

The teeth of *Ptychodus Mortoni* I have seen only from the cretaceous formation of Alabama and Mississippi. Morton, in the work above noticed, figures a tooth, but does not mention the locality from which it was obtained.

Agassiz, in his Poissons Fossiles, gives a good representation of a tooth of this species, from the Green Sand of America, in three views, figs. 1-3, Tab. 25.

Dixon, in his Geology of Sussex, represents two small teeth, (figs. 6, 7, pl. xxi), which he refers to the same species. Though exhibiting some resemblance in character to the American teeth, I think a further comparison is necessary to establish their specific identity.

The teeth of *Ptychodus Mortoni* are well defined in character, and in comparison with teeth of well recognized European species are almost generic in their peculiarity. Though exhibiting some variety, their likeness presents a distinct specific uniformity. Their size of course varies greatly with age and the relative position they occupied with one another in the mouth of the fish.

Viewed from above, the crown is reniform in outline, the long diameter being transverse; the incurvature posterior. The crown rises in the form of a cone with a more or less obtuse summit. The sides of the crown slope to the base and frequently more or less abruptly expand, laterally approaching the latter. The back part is occupied by a wide triangular sinus for the reception of the fore-part of the crown of the tooth which was situated in front of it when the teeth were contained within the mouth. The border of the crown is thick and rounded and dips beneath. At the sinus it is prominent. The summit of the crown presents a prominent crucial ridge, more or less distinct in different specimens. From the cross numerous ridges of about the same thickness diverge upon the sides of the cone, branching in their course, multiplying and becoming finer, and ultimately conjoining upon the base in a fine reticulation extending to the borders of the crown. The coarser ridges vary in their proportionate length in different specimens. The reticulation of the base is most extensive laterally, occupying usually half the breadth of the space between the summit and border. It also occupies the sinus, and is least developed at the fore-part of the crown. The width of the crown approaches double the 1868.]

fore and aft measurement, and the height is usually little less than the latter. The root partakes of the form of the outline of the base of the crown, but is more square and is flat or transversely concave below.

Twelve specimens of teeth of *Ptychodus Mortoni*, from the Cretaceous Formation of Alabama, belonging to the Yale College Museum, have been submitted to my examination by Mr. William M. Gabb. Among them occurs the largest tooth of the species I have seen, and larger than any on record. It is labelled as having been derived from Perry Co., Alabama. The fang and parts of the lateral and back borders of the crown are broken away. In the perfect condition the crown has measured a little over two inches in transverse diameter, one inch and a quarter antero-posteriorly, and ten lines in height. The crushing surface is proportionately less prominent at the centre than in the smaller teeth attributed to the same species, and is more uniformly convex, or less expanded laterally at the base. The borders of the posterior sinus also are less abrupt or defined. The unworn summit presents a crucial ridge, of which the lateral radii are most distinct and directed postero-laterally. From the crucial ridge, numerous ridges, equally prominent, diverge, branch in their course and ultimately conjoin in a fine reticulation at the base of the crown. This reticulation has the greatest breadth at the sides of the crown and is least developed at the fore-part.

Eleven teeth from Uniontown, Alabama, exhibit a gradation in size from less than three-fourths that of the above described specimen down to one little more than a fourth of its diameter. The specimens present a remarkable similitude throughout. Some are proportionately wider fore and aft than others, and the smallest are proportionately higher than the largest ones. The outline of the base of the crown is reniform, with the relation of the longer and shorter diameters varying. The largest specimen has the crown an inch and a half wide, a little over three-fourths of an inch fore and aft, and about half an inch in height. The sides of the crown expand at the base laterally; the fore-part forms nearly a uniform slope, and the back surface slopes to the sinus, which forms a broad triangular depression. The fang is fourteen lines wide, seven lines fore and aft, and three lines in depth.

The crown of a median sized tooth of the series, unworn, measures scant 14 lines wide, $7\frac{1}{2}$ fore and aft, and $6\frac{1}{2}$ high. The smallest specimen has the crown 7 lines wide, $4\frac{1}{2}$ fore and aft, and an equal height. Its base laterally appears more abruptly expanded than in the others. Most of the specimens are unworn and exhibit the characteristic ridges of the crown in a striking manner. In three specimens the coarser ridges are resolved into the reticulation much earlier or nearer the summit than in the others. In one specimen the crown is smooth or totally devoid of ridges, presenting the same appearance represented in figs. 4, 5, pl. xxx, of Dixon's Geology of Sussex, and described as "nascent or incomplete teeth of *Ptychodus*."

Seven specimens of teeth in the Museum of the Academy, from Alabama, exhibit the same characters expressed in the description of those above. They all present an unmistakeable specific likeness, though varying in the proportions of their diameter. The largest specimen has the crown 16 lines wide, 11 lines fore and aft, and 8 lines high. The root is an inch wide, 7 lines fore and aft and nearly 3 lines thick. A second specimen, with the crown 16 lines wide and 9 lines fore and aft, has been proportionately lower than the former. Its summit is worn away, leaving an exposed circular disk of vaso-dentine 4 lines in diameter.

Two specimens in the Museum of the Academy, presented by Prof. Joseph Jones, are from Green Co., Alabama. The larger is perfect and unworn. The crown is scant 14 lines wide, by 7 lines fore and aft, and 5 lines high. The root is $11\frac{1}{2}$ lines wide, $4\frac{1}{2}$ fore and aft, and 2 lines thick.

Two specimens in the Museum of the Academy, presented by Dr. Wm. Spillman, are from Columbus, Mississippi. They present the same character as the Alabama specimens. The larger specimen has the crown 20 lines wide, 10 lines

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fore and aft, and has perhaps been about 8 lines high. The summit is worn off, leaving an exposed flat circular surface of vaso-dentine half an inch in diameter. The root is 15 lines wide, 6 lines fore and aft, and three lines thick. The smaller specimen consists of an unworn crown $11\frac{1}{2}$ lines wide, 7 lines fore and aft and $5\frac{1}{2}$ lines high.

PTYCHODUS OCCIDENTALIS, n. s.

The Museum of the Academy contains a specimen consisting of the crown of a tooth of a species of *Ptychodus* differing from any other previously known. It was obtained by Dr. John L. LeConte, in association with other remains of fishes, from an ash-colored rock of the Cretaceous series, a few miles east of Fort Hays, Kansas.

The tooth is remarkable, especially from the comparatively near approximation of its diameters, the width transversely and fore and aft and the height approaching one another more nearly than in any other species. The fore-part of the crown is somewhat injured and the root is broken away. The transverse diameter of the crown at base is 14 lines; the fore and aft diameter has been about an inch; and the height is also an inch.

In shape the crown is a blunt cone with the sides sloping evenly to the base and to the posterior sinus. The latter is a triangular concavity about two-thirds of the breadth in height.

The direction and arrangement of the ridges of the crown are much like as in the European *Ptychodus decurrens*, but the principal ridges crossing the crown transversely are finer and the intervals much narrower, indeed the space occupied by a pair of ridges with their interval in *P. decurrens* would accommodate three ridges with a pair of intervals in *P. occidentalis*. Descending the sides of the cone the ridges branch as in *P. Mortoni*, and at the basal half of the crown form a reticulation much as in *P. decurrens*. At the back of the summit of the crown the principal ridges continue their transverse or parallel course until near the upper part of the sinus, into which as they descend they are resolved into a fine reticulation. The fore-part of the crown is occupied by a reticulation formed by the descent, convergence and division of the more anterior principal ridges.

From the description it will be observed that the tooth holds an intermediate position in anatomical character to those of *Ptychodus Mortoni*, and *P. decurrens*.

Three small teeth, found by Dr. Le Conte in association with the latter, resemble, in their proportions and in the proportionate size and arrangement of the ridges of the crown, the teeth of *P. decurrens*, but perhaps may belong to the same species as the large tooth above described. The larger of the three specimens is perfect, but has the summit of its crown worn off. The crown measures 7 lines transversely, 6 lines fore and aft, and has been from 4 to 5 lines high. The root is 6 lines wide, $4\frac{1}{2}$ lines fore and aft, and $2\frac{1}{2}$ lines thick. Comparatively coarse ridges cross the crown transversely, curving forward laterally and ending in a marginal reticulation. Branching ridges descend in front from the foremost of the transverse ridges, and likewise end in a marginal reticulation. The sinus is occupied by a finer reticulation joined by fine ridges descending from the summit and sides of the crown. The smallest tooth, likewise perfect, has the crown $4\frac{1}{2}$ lines wide, $3\frac{1}{2}$ lines fore and aft, and $2\frac{1}{2}$ lines high.

Three additional specimens associated with the former ones, are the smallest teeth of *Ptychodus* I have seen, but I suspect that they belong to the same species. They are transversely ellipsoidal in outline at the base of the crown, and this appears as a low cone elevated at the inner third and with a broad expanding base. The sinus is situated at the inner posterior third. The surface of the crown is crossed with transverse ridges which form a narrow reticulation at the border. The largest of these small specimens is $3\frac{1}{2}$ lines transversely, $1\frac{3}{4}$ fore and aft, and $\frac{3}{4}$ of a line high from the root. The smallest tooth is $2\frac{1}{4}$ lines wide, $1\frac{1}{2}$ fore and aft, and $\frac{1}{2}$ a line from the root.

1868.]

PTYCHODUS POLYGYRUS.

Agassiz : Poissons Fossiles III, 156 ; Dixon : Geology of Sussex, 1850, 363.
Gibbes : Jour. Acad. Nat. Sci., 1849, 299, pl. 42, figs. 5, 6.

Dr. Gibbes, in the work above noticed, figures two teeth, from the cretaceous formation of Alabama, which he refers to *Ptychodus polygyrus*. They clearly bear a close likeness to specimens of the European species of that name.

A single specimen of a tooth, accompanying the Alabama specimens belonging to the Yale College collection, resembles the teeth of the European *Ptychodus polygyrus*. The crown is nearly square or transversely oblong, with the fore and back borders nearly straight, and the lateral borders convex. The crushing surface is moderately convex and is crossed transversely by ten coarse acute ridges, separated by similar intervals. The borders of the surface, including the posterior sinus, are occupied by comparatively fine vermicular and interrupted ridges, appearing like granulations. The coarse ridges are nearly straight, and at the end rather abruptly resolve themselves into the finer vermicular ridges of the border. From European specimens of the teeth of *P. polygyrus* and *P. latissimus*, this tooth appears especially to differ in the proportionately greater degree of fineness of the bordering vermicular ridges or granulations of the crown. Its measurements are as follows :

Width of crown 13 lines ; fore and aft 11 lines ; height $5\frac{1}{2}$ lines ; width of fang 8 lines ; fore and aft $6\frac{1}{2}$ lines ; thickness 3 lines.

Of other species of *Ptychodus*, Agassiz mentions teeth of *P. mammillaris*, found in the excavation of the Delaware canal, and preserved in the Museum at Paris. (Pois. Fos. III, 151.) I have seen no specimens of that species from an American locality.

Synopsis of the Extinct BATRACHIA of North America.

BY EDWARD D. COPE, A. M.

BATRACHIA.

The vomer is double, and usually bears teeth in this class ; the premaxillary is usually double ; Amphiuma and Spelerpes belli are exceptions. Teeth never planted in deep alveoli.

There are six orders, as follows :

TRACHYSTOMATA.

Caudal vertebræ and frontal bones distinct.

Inferior pelvic elements not confluent.

O. o. maxillaria, prefrontalia, palatina and pterygoidea wanting ; nasalia present.

Ethmoid,* two lateral pieces, each forming part of palate.

Mandible toothless, condyloid.

No "postorbital and supertemporal bones."

First pair ceratohyals distinct.

PROTEIDA.

Caudal vertebræ and frontal bones distinct.

Inferior pelvic elements not confluent.

O. o. maxillaria, prefrontalia and nasalia wanting ; palatina and pterygoidea present.

Ethmoid,* a vertical plate on each side the cerebral lobes.

Mandible toothed, teeth pleurodont.†

* Erroneously called orbitosphenoids by me, Jour. Acad. 1866 (on Anura).

† The statement made by Dr. Gray that the teeth of Necturus are canaled, as in venomous serpents, by a channel entering at the base and issuing below the tip, appears to the writer to be of doubtful accuracy. No other opening exists in the teeth of Necturus ma-